

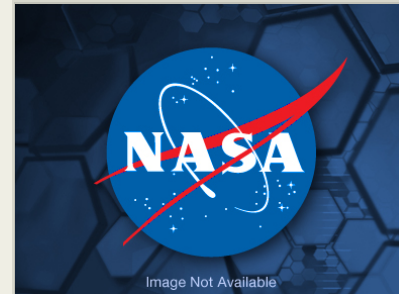
# Advanced Development of a Multi-Angle Stratospheric Aerosol Radiometer (MASTAR)

Completed Technology Project (2017 - 2018)



## Project Introduction

The contribution of atmospheric aerosols to the Earth's energy budget is an important, yet relatively uncertain, component of the Earth system. Stratospheric aerosols represent a less well-studied, but nevertheless significant, element of this contribution through their impact on direct radiative forcing of the climate system. Comprehensive measurements of aerosol extinction vertical profiles with dense spatial sampling are needed to better constrain climate model simulations of aerosol extinction, composition, and particle size, in order to compute climate impacts. The most effective source of stratospheric aerosol extinction data comes from satellite limb scattering measurements, which provide greater sensitivity than space-based lidar and much better spatial sampling than occultation measurements. The Ozone Mapping and Profiling Suite (OMPS) Limb Profiler (LP), currently flying on the Suomi National Polar-orbiting Partnership (S-NPP) satellite, has been providing daily aerosol extinction profile data from limb scattering measurements since April 2012. While the S-NPP OMPS LP instrument was designed for a 7-year operating lifetime, the next OMPS LP instrument is not scheduled to fly until 2022. This raises the possibility of a data gap in this crucial measurement. We have developed a prototype instrument, called Global Aerosol Monitoring System (GAMS), to supplement the OMPS LP measurements. Our design uses multiple viewing directions to improve spatial sampling and provide more balanced measurement sensitivity throughout the orbit compared to OMPS LP. Wavelength selection in this design is limited to simple filters (675 nm for aerosol science, 350 nm for altitude registration) to enable a compact instrument suitable for Cubesat deployment. This prototype instrument has been developed with NASA GSFC internal funding, and currently meets TRL 2 criteria. This proposal to the Instrument/Measurement Concept Demonstration subelement of the Instrument Incubator Program (IIP-ICD) describes our plans to improve the GAMS design to produce a more scientifically capable and flight-ready instrument (Multi-Angle Stratospheric Radiometer, MASTAR). The MASTAR concept was formally submitted to the 2017 Decadal Survey for Earth Science second request for information in May 2016. Adding a second channel at 1020 nm for science measurements will improve aerosol detection capabilities at low altitudes, help determine aerosol particle size properties, and increase continuity with heritage data sets. Optical design studies will be performed to optimize the performance of MASTAR and quantify stray light behavior. We will also assess the potential benefits of incorporating onboard data processing capabilities to satisfy the science objectives. The goal of this effort is to have a laboratory tested MASTAR instrument at TRL 4 by the end of the IIP award period. We do not include a Data Management Plan in this proposal, following guidance provided at the NSPIRES web site.



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## Organizational Responsibility

### Responsible Mission Directorate:

Science Mission Directorate (SMD)

### Lead Organization:

Science Systems and Applications, Inc. (SSAI)

### Responsible Program:

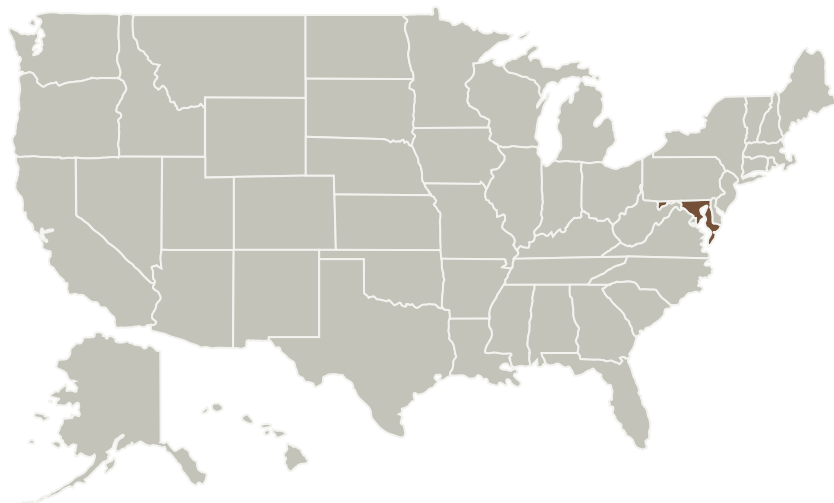
Instrument Incubator

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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Science Systems and Applications, Inc.(SSAI)	Lead Organization	Industry	Hampton, Virginia

### Primary U.S. Work Locations

Maryland

## Project Management

### Program Director:

Pamela S Millar

### Program Manager:

Parminder S Ghuman

### Principal Investigator:

Matthew T Deland

### Co-Investigators:

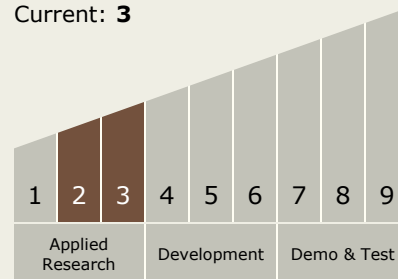
Peter R Colarco

Janine M Good

Nick Gorkavyi

## Technology Maturity (TRL)

Start: 2  
Current: 3



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.4 Microwave, Millimeter-, and Submillimeter-Waves

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## Target Destination

Earth